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GLAZING

SESSION 2



HOMEOWNERS TRAINING COURSE

AT

NEWARK REDEVELOPMENT AND HOUSING AUTHORITY

MAINTENANCE TRAINING CENTER

4 Sheffield Drive

Newark, N.J. 07104

Saturday, September 19, 1977

9:00 a.m. - 1:00 p.m.

Instructor: John Borgess

G L A Z I N G

Session #2 Glazing - and Equipment

- a) Safety equipment and its usage.
- b) Identify proper tools and explanation of their usage.
- c) Instruction and practical demonstration of removing old glass. Cutting glass and installing new glass (class participation).
- d) Instruction and practical demonstration of removing old plastic and cutting and installation of plexiglas- lexon and garlite.
- e) Ladder safety.



REPLACE A BROKEN WINDOW

YOUR PROBLEM

- A window is broken.
- Heat is lost around window panes where putty is missing or dried out.



WHAT YOU NEED

- Window glass—correct size
- Putty or glazing compound
- Putty knife
- Hammer
- Pliers
- Glazier points



HOW-TO

1. Work from the outside of the frame. (Fig. 1)
2. Remove the broken glass with pliers to avoid cutting your fingers. (Fig. 2)
3. Remove old putty and glazier points. Pliers will be helpful to do this. (Fig. 3)
4. Place a thin ribbon of putty in the frame. (Fig. 4)
5. Place glass firmly against the putty. (Fig. 5)



Fig. 1



Fig. 2



Fig. 3



Fig. 4



Fig. 5

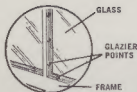


Fig. 6



Fig. 7

6. Insert glazier points. Tap in carefully to prevent breaking the glass. Points should be placed near the corners first, and then every 4 to 6 inches along the glass. (Fig. 6)
7. Fill the groove with putty or glazing compound. Press it firmly against the glass with putty knife or fingers. Smooth the surface with the putty knife. The putty should form a smooth seal around the window. (Fig. 7)

YOUR REWARD

- Rain, cold, dust and insects are kept out.
- The house looks better.
- You save money by doing the job yourself.

NOTE: Wear protective clothing such as leather gloves, goggles and long sleeves when breaking out glass.

Avoid wearing goggles while climbing or descending a ladder - drop them to your chest or raise them to your forehead until you are ready to use them.

Do not wear dirty or defective goggles.

GLASS AND GLAZING

CLEAR glass such as is used for glazing windows is known as sheet glass. Three grades are normally obtainable, and selection should be made in accordance with the work in hand.

Types of glass

Best. This should be free of all distortion and other blemishes, and is used for best quality work where faults would show badly. Thus it is used for pictures, best partition and window work, and so on.

Seconds. For general purposes—windows being the main use.

Thirds. Poorer quality work in which distortion does not matter—greenhouses, garden frames, and so on.

Thickness varies, and is chosen chiefly in accordance with the size of pane. It is known by the weight of glass in a square foot. Thus, a piece of glass 12 in. by 12 in. weighing 21 oz. is known as 21 oz. The thinnest glass in ordinary everyday use is 15 oz. and is suitable for the smallest panes only. It would break too easily if used in larger sizes. Most small window panes require 21 oz. glass, but for good work 26 oz. is better. For large panes this should be increased to 32 oz. The following is a general guide to the thicknesses of the various weights:

15 oz.— $\frac{1}{16}$ in. full.	26 oz.— $\frac{1}{8}$ in.
18 oz.— $\frac{1}{8}$ in.	32 oz.— $\frac{3}{16}$ in.
21 oz.— $\frac{1}{4}$ in.	42 oz.— $\frac{1}{2}$ in.
24 oz.— $\frac{3}{8}$ in. full	

Plate glass.—For first-class work plate glass is used. This is ground flat and is polished, and is thus free from all distortion. Thicknesses are from $\frac{3}{16}$ in. upwards. For shelves, partitions, doors, and so on the edges can be ground flat with the corners rounded or they can be pencil rounded. Holes can also be ground in it for fixing or to form finger grips.

HOW GLASS IS CUT

Other varieties of glass for special purposes are those with deliberately undulating surfaces, the purpose of which is to let through light but to prevent a clear vision being obtained. These include reeded, chequered, rippled, and other patterns. Some have a deep irregular diaper pattern cast in them for the same purpose. Wired glass in various meshes, toughened glass, tinted glass, prismatic glass, and glass slates and tiles are also made.

Glass cutting—This is done with either a diamond or a wheel. Straight cuts are simple if the cutting tool is properly used. The glazier uses a special T-square which has a notch cut in the cross piece to allow the cutter to begin right at the edge. It is doubtful



FIG. 1. CUTTING GLASS, CUTTER BEARING AGAINST STRAIGHT-EDGE

whether the home craftsman will have one of these, and it is necessary to use a straight-edge. For small cuts this can be held down with one hand whilst the cutter is used with the other. If the pane is large it is safer to place a weight on one end, the hand being used to steady the other. Remember that the diamond or wheel is set in the middle of the tool and this affects the position of the straight-edge. Thus, the latter is not on the line to be cut but to one side by an amount equal to the distance of the diamond from the side of the tool.

It is essential that the glass is laid on a flat board when being cut, preferably with felt or baize covering. Failing this sheets of newspaper can be placed upon it. Any serious distortion of the surface can result in the glass being cracked. The angle at which the cutter

GLASS AND GLAZING

is used is found by experience, and it is strongly advisable to make practice cuts on waste pieces first. After a while the characteristic hiss of the diamond or wheel properly cutting can be detected. The cut should start tight at the far side and continue across in an unbroken stroke. Fig. 1 shows the operation.

Square cutting—It is of course important that the cut is square, hence the reason for the glazier using a T-square. A simple alternative is that in Fig. 2. A pencil line is drawn square across the board, and two nails knocked partly in. Two more nails are now

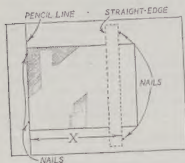


FIG. 2. SIMPLE METHOD OF ENSURING THAT GLASS IS CUT SQUARE
Distance X is required, that is, less half thickness of cutter head.

FIG. 3. SNAPPING GLASS CLEANLY AT THE CUT



tapped in distant from the line by a measurement equal to the required glass size less half the thickness of the cutter head. The glass is placed hard up against the first nails, and the straight-edge against the second nails.

Having made the cut, raise the glass at one edge, and tap the underside along the line to deepen the cut. Replace the glass on

REMOVING OLD GLASS

the board with a match stick immediately beneath the line as in Fig. 3, and press down with the thumbs at each side. The waste should then snap across cleanly.

Size to cut—No matter what the purpose for which the glass is needed, it should be an easy fit in its rebate. The amount depends upon size. For small items about $\frac{3}{4}$ in. all round is ample, but for frames of any size $\frac{1}{8}$ in. should be allowed. Remember that the glass should not touch the wood at its edges, but should have a bed of putty all round. This does not apply to picture frames, but even here the glass size should be smaller than the rebate size by about $\frac{1}{16}$ in. in each direction.

For the handyman most glazing consists of the replacement of broken panes, but in new work it should be remembered that the rebate in which the glass fits must be given a coat of priming before putty is used. Unless this is done the putty is liable to drop away owing to the oil in it being absorbed by the bare wood. The same thing, of course, applies to old work if the removal of the old putty reveals bare wood.

Removing old glass—To replace a broken pane it is necessary first to knock out the glass fragments and to clean away old putty. Generally this can be done with the window in position, though in the case of a large frame with single pane it is often more convenient to remove the whole and do the work on the bench. For an upstairs window when no ladder is available this is probably essential.

A hacking knife or old chisel is used to remove the putty. Often it is necessary to use a hammer to the tool, but this calls for special care when there are other panes in the same frame because they are easily jarred and cracked. Endeavour to press the tool beneath the putty, and work round both surfaces of the rebate. Often one or two nails are revealed, these having been partly knocked in to hold the glass whilst the putty is bedded in. These should be withdrawn so as not to interfere with the new glass. If any bare wood is uncovered it should be given a coat of priming. Cut the glass with clearance all round as already noted.

Puttying—This not only serves to hold the glass in, but also acts as a bed in which the latter rests and gives close support all round. In addition it keeps out draughts by closing all gaps. Press a small bed of putty into the rebate all round as at (A), Fig. 4. Providing

GLASS AND GLAZING

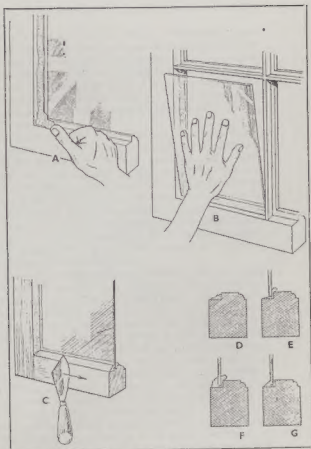


FIG. 4. STAGES IN PUTTYING A WINDOW GLASS

APPLYING PUTTY

that the whole of the rebate all round is covered no attempt at smoothing is necessary. Press the pane in evenly all round as at (B). If the frame is vertical the bottom can be placed in first and the top then pressed in. Open the fingers so that the pressure is as even as possible all over.

In the case of a large pane use both hands to distribute the pressure. This will squeeze out putty at the moulded side as at (E), but this for the time being is ignored. If pressure is too local it will bend the glass slightly and this will spring back and leave a gap. For most panes nails should be knocked in at top and bottom and driven to just below the level of the putty. For small panes it is unnecessary, but a precaution is to press in a lump of putty temporarily at each corner.

More putty is now thumbed in all round and pressed well down. This stage is shown at (F). With the putty knife smooth the putty at an angle so that the top is level with the moulding. Draw knife steadily along, the point touching the glass as at (C). This will remove all surplus which is pressed into a ball and kept for use elsewhere. If the knife is twisted round as the mitre is reached a really clean finish is achieved. Finally the surplus at the moulding side is removed. Here it is important that no gaps are left between glass and moulding. If they should occur they should be filled straightway. Undue pressure on the glass should be avoided. The final stroke with the knife is flat down on top.

Beaded glass—Sometimes partitions, furniture, etc. have glass held with wood beads rather than putty, especially on polished rather than painted work. These are nailed in, but if it is essential that all draught is excluded, it is advisable after placing the glass in position to press in putty between the edge of the glass and the rebate. This seals it and also has the advantage of largely stopping rattle. For curved frames the wood bead can be bent if the curve is slight only, but for acute bends the common practice is to use a strip of lino, the edge of which can be rounded over to a bead shape.

Mirrors—When a mirror is to be held in a rebated frame it is important that nothing touches the actual silver backing as it is almost sure to mark in time. The most satisfactory way is to use little wedge-shaped pieces which are glued to the rebate as in Fig. 5. Place the frame rebate uppermost on a flat surface, or put two battens beneath and adjust these with wedges until the frame is free

GLASS AND GLAZING

front winding. Both sides of the rebate are now blacked or at least stained a dark color. This is especially important on a mirror which is stained dark on other surfaces. Otherwise the mirror

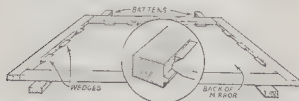


FIG. 5. MIRROR FIXED IN FRAME WITH TAPERED WEDGES GLUED IN REBATE.

reflects the bare wood and looks unsightly. The mirror should be at least $\frac{1}{4}$ in. clear of the rebate all round, and is placed in position with the gap equalized. Small wedge-shaped pieces are prepared about 3 in. long each and are glued to the rebate only. When the glue has set the frame is ready for use, and needs only the back to be added.

HOW
TO INSTALL
PLASTIC
ACRYLIC SHEET
FOR SAFETY
GLAZING



PLEXIGLAS

Plexiglas is an approved safety glazing material under state statutes and building codes that require the use of safety glazing in hazardous locations such as storm doors, shower and tub enclosures, and other types of doors and windows. Plexiglas is rigid, light weight, and completely transparent. It will not discolor even after years of exposure to sun and weather. It is also easy and safe to handle, cut-to-size, and work with. You can make glazing replacements yourself by following these instructions:

Selecting Thickness

Safety glazing with Plexiglas provides impact resistance and safer fragmentation. The thicker the Plexiglas, the greater its impact resistance. If broken, Plexiglas breaks into large dull-shaped pieces which travel at low velocity, seldom causing injury.

Measuring Opening

Plexiglas should be cut slightly smaller than the opening to allow for thermal expansion of the material. Measure the opening. Then subtract the thermal expansion factor from the length and width measurements. The thermal expansion factors are given in the table below.

Thermal Expansion Factors

Long Dimension	Subtract
12" to 36"	1/16"
37" to 48"	1/8"
49" to 60"	3/16"

Cutting Plexiglas

Plexiglas can be cut with a circular saw, sabre saw, or by scribing and breaking. Do not remove masking paper until after cutting. The masking paper will protect the surface and reduce friction and gumming behind the blade. Sanding edges to remove saw marks will assure maximum breakage resistance.

Circular Saws - Use a steel cross-cut blade of the type recommended for finish cuts on plywood, veneers, laminates, etc. The blade should have six teeth per inch. All teeth should be of the same shape, height, and point-to-point distance.

Set the blade just higher than the thickness of Plexiglas to prevent chipping. Do not force feed.

Sabre Saws - Use a blade with 24 to 32 teeth per inch for 1/10" and 1/8" thick Plexiglas, and 14 to 24 teeth per inch for 3/16" and 1/4" thick material. For best results, clamp a straight edge to the material as a guide for the saw as shown.

Scribing & Breaking - Use either the Plastic Plus Cutting Tool for Plastic Glass

- a. Scribe the several times (5 to 6 passes of the blade for 1/10" and 1/8" thicknesses of Plexiglas; 7 to 10 times for 3/16" and 1/4" thicknesses).
- b. After scribing, place the scribed line face-up over a 3/4 inch wood dowel; to break, hold with one hand and apply downward pressure on the short side of the cut with the other.

Glazing Compounds

Plastic expands and contracts a little with temperature and humidity changes, therefore, only non-hardening glazing compounds (putty) or silicone sealants should be used.

Cleaning Plastics

Clean with a 1% solution of dishwashing liquid (or other mild soap or detergent) and water. Use only a soft, clean cotton flannel or jersey cloth. Remove tar, grease or paint with a good grade of naphtha or kerosene.

Periodic waxing with a good grade of automobile paste wax (not a cleaner-wax combination) such as Paste Wax will fill in most minor scratches on the surface of the Plexiglas and help maintain its beautiful lustre. Apply a thin coat and buff to shine. Use only a soft, clean, cotton flannel or jersey cloth.

Permanent Labeling of Approved Safety Glazing Materials is Required by Law

In states with safety glazing laws or with building codes that require safety glazing in hazardous locations, each pane of material sold must be permanently marked indicating tradename, company, type of material, ANSI Z97 approval, and minimum thickness as shown below on acrylic safety glazing.

Storm Door Replacement

METHOD A

Plexiglas in "Drop-In" Frames

1. Remove the sash with the broken glass and lay it flat on a worktable. Using a screwdriver or putty knife loosen the rubber gasket and then pull it out of the sash.
2. Carefully remove the broken glass; then clean the rubber gasket and sash of all dirt and glass fragments.
3. Measure the frame opening and subtract the thermal expansion factor. Locate the permanent safety glazing label on the edge of the sheet. Trim the sheet of Plexiglas to size making sure not to cut off label.
4. Remove the protective masking paper.
5. Place the Plexiglas into the sash and gently press the rubber gasket into place with a putty knife. Note: Soaking the gasket in warm soapy water will help make it soft and easier to install. If gasket is worn, dried out, and cracked, replace it with a new gasket.

Storm Door Replacement

METHOD B

In 3/16" or 1/4" thicknesses, Plexiglas can be installed right into the door opening unframed. This is a much easier method of installation for the do-it-yourselfer. Because thicker material is used, more breakage resistance is provided as well.

1. Remove the frame with the broken glass from the door and discard.
2. Measure the door opening and subtract the thermal expansion factor. Locate the permanent safety glazing label on the edge of the sheet. Trim the sheet of plastic to size making sure not to cut off labeling.
3. Sand the edges with medium grit (60-80) paper to remove saw marks. Round the edges slightly.

Storm Door Replacement

METHOD B (continued)

4. Remove the protective masking paper and installed 3/16" or 1/4" thick plastic unframed, right into the opening.
5. Tighten the clips until snug, just as you would for a frame. If the material is too thin to be firmly retained by the existing clips, use wood spacers or spring loaded clips.

Wood Sash Replacement

1/10" or 1/8" Plastic

1. Remove the wood strips or glazing compound (putty) and broken glass.
2. Measure the opening and subtract the thermal expansion factor. Locate the permanent safety glazing label on the edge of the sheet. Cut the plastic to size making sure not to cut off the labeling.
3. Remove the protective masking paper.
4. Put a thin bead of an elastic (non-hardening) putty or silicone sealant around inside of rabbet and press plastic pane in place.

IF USING WOOD STRIPS TO HOLD WINDOW PANE, GO ON TO #5 BELOW. IF USING GLAZING COMPOUND (PUTTY), GO ON TO #6 BELOW.

5. Replace the wood strips.
6. Fasten the plastic pane in place with glazier's points 5" or 6" apart.
7. Lay a smooth triangular line of glazing compound in the rabbet with a glazing trowel or putty knife.

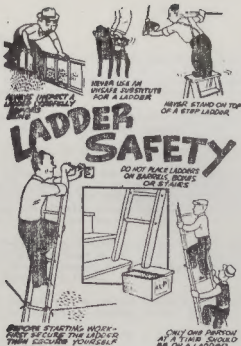
Shower Door Replacement

3/16" Flair

Hammered Glass Pattern

1. Carefully remove the shower door and lay it flat on a worktable.

2. Remove screws on all four ends of the shower door frame.
3. Carefully remove both end pieces of door frame.
4. Remove the broken glass and clean the rubber gasket and frame.
5. Measure the frame opening and subtract the thermal expansion factor. Locate the permanent safety glazing label on the edge of the sheet. Cut to size with a circular saw or sabre saw.
Flair patterned is not supplied with a protective masking paper; to avoid gumming behind the saw blade, apply masking tape on both sides of the intended cut.
Sand the edges smooth with 60-80 grit paper. Flair hammered glass pattern Flexiglas cannot be scored and broken because it is patterned on both sides.
6. Fit the rubber gasket around plastic sheet. If a glazing compound is used instead of a rubber gasket, use a silicone sealant to seal the material in the frame.
7. Gently press the frame over the gasket on all four sides; replace the screws and rehang the door.



Wood ladders that are painted are especially dangerous; moisture can get into the joints, between the rungs and side pieces, and rot out the rungs.

Painting of ladders prevent inspection of the wood for cracks and rotting.

The best treatment for a ladder is a coat of clear wood preservative.

ALWAYS
PLACE
LADDER
at a
SAFE
ANGLE



*Ladder is at
a safe
angle when
Distance "B"
equals
approx. $\frac{1}{4}$ of
Distance "A"*

LADDER SAFETY

Ladders

Inspect and test your ladder frequently for defects which might impair the strength of the ladder. Never use a ladder with any parts broken, decayed, loose, crushed or badly worn or which on test shows any evidence of weakness. If ladder has splintered surface, correct the condition before using.

Avoid dropping a ladder or otherwise subjecting it to undue strain which may produce defects and impair the strength of the ladder.

Before climbing, be sure both feet of the ladder rest evenly on secure footings.

If the surface on which the ladder feet rest is of such a nature that the ladder may have a tendency to slip, or if the ladder cannot be placed at the proper angle, tie or brace the base securely or have someone hold the base to prevent slipping. On slightly uneven surfaces use a flat piece of board or small wedge to even up the ladder feet.

To secure the proper angle, the base of the ladder should be placed so that the distance from the base of the ladder to a line dropped vertically from the top support is approximately $\frac{1}{4}$ the distance from the base to the top support, measured along the ladder.

Be sure the top support of the ladder is reasonably rigid and has ample strength to sustain the maximum loading of the ladder.

Only one person should work on a ladder at a time.

When getting off a ladder, avoid stepping on loose stones or debris, or into a depression. If practicable, clear the grounds at the base before climbing.

If you are asked to hold a ladder, remember that it is a real man's job. The life of the workman, while he is on the ladder, rests in your hands.

While on a ladder, do not attempt to lean so that any part of your body (except arms or handle) extends more than 12 inches beyond the side rail. Avoid standing with one foot on a ladder and one foot on a nearby object.

Do not place ladders on boxes, barrels, or other objects to obtain additional height; procure a ladder of sufficient length to complete the work.

Do not hurry in going up or down a ladder. Take one step at a time. Always face the ladder when ascending or descending. When climbing ladders, it is good practice to grasp the side rails.

Be careful that tools and materials being used aloft do not fall on persons passing beneath. Avoid leaving tools or materials lying on or hanging from ladders, or in any other overhead position where they might fall.

Keep off unsafe substitutes for ladders.

Before moving a ladder, make sure that there is no person, tool or material on it.

Keep ladder rungs and side rails free from grease, dirt, wax, etc.

LADDER SAFETY

Ladders

When working from a straight type ladder, do not stand above the fourth rung from the top. Secure a longer ladder if necessary.

Always have the top section lowered when moving an extension ladder from one location to another.

Be sure both latches are firmly engaged and the rope securely tied to one of the rungs of the lower section before climbing the ladder. As an extra precaution, inspect the latches as you pass them.

Use care while extending and lowering the upper section of a ladder to prevent injury to the hands or feet.

Avoid using a stepladder as a straight ladder.

See that a stepladder is fully opened and the spreaders properly set, before it is used.

Do not stand on the top of a stepladder--get a longer ladder.